

## LICENSEE EVENT REPORT (LER)

(See reverse for required number of  
digits/characters for each block)ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY  
INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED  
ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO THE  
INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE  
INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR  
REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE  
PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND  
BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

Fort Calhoun Station Unit No. 1

DOCKET NUMBER (2)

05000285

PAGE (3)

1 OF 5

TITLE (4)

Emergency Diesel Generator Start Due to Failure of One of the Off Site Power Sources

| EVENT DATE (5)        |     |      | LER NUMBER (6)   |                      |                    | REPORT DATE (7) |                   |      | OTHER FACILITIES INVOLVED (8)                    |               |
|-----------------------|-----|------|--|----------------------|--------------------|-----------------|-------------------|------|--|---------------|
| MONTH                 | DAY | YEAR | YEAR   | SEQUENTIAL<br>NUMBER | REVISION<br>NUMBER | MONTH           | DAY               | YEAR | FACILITY NAME                                    | DOCKET NUMBER |
| 05                    | 20  | 1998 | 1998   | -- 005 --            | 00                 | 06              | 19                | 1998 |  | 05000         |
| OPERATING<br>MODE (9) |     |      | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFRs. (Check one or more) (11) |                      |                    |                 |                   |      |  |               |
| 5                     |     |      | 20.2201(b)   |                      | 20.2203(a)(2)(v)   |                 | 50.73(a)(2)(i)    |      | 50.73(a)(2)(viii)                                |               |
| POWER<br>LEVEL (10)   |     |      | 20.2203(a)(1)  |                      | 20.2203(a)(3)(i)   |                 | 50.73(a)(2)(ii)   |      | 50.73(a)(2)(x)                                   |               |
| 0                     |     |      | 20.2203(a)(2)(i)   |                      | 20.2203(a)(3)(ii)  |                 | 50.73(a)(2)(iii)  |      | 73.71  |               |
|                       |     |      | 20.2203(a)(2)(ii)  |                      | 20.2203(a)(4)      |                 | X 50.73(a)(2)(iv) |      | OTHER  |               |
|                       |     |      | 20.2203(a)(2)(iii)   |                      | 50.36(c)(1)        |                 | 50.73(a)(2)(v)    |      | Specify in Abstract below<br>or in NRC Form 366A |               |
|                       |     |      | 20.2203(a)(2)(iv)  |                      | 50.36(c)(2)        |                 | 50.73(a)(2)(vii)  |      |  |               |

## LICENSEE CONTACT FOR THIS LER (12)

NAME

Erick Matzke, Station Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

402-533-6855

## COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE<br>TO EPIX |  | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE<br>TO EPIX |
|-------|--------|-----------|--------------|-----------------------|--|-------|--------|-----------|--------------|-----------------------|
| E     | FK     | XFMR      | G080         | Y                     |  | E     | KP     | CKV       | U077         | Y                     |
| E     | KP     | XCV       | V120         | Y                     |  |       |        |           |              |                       |

## SUPPLEMENTAL REPORT EXPECTED (14)

YES  
(If yes, complete EXPECTED SUBMISSION DATE)

X

NO

EXPECTED  
SUBMISSION  
DATE (15)

MONTH

DAY

YEAR

## ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

At 1410 Central Daylight Time, on May 20, 1998, the 161kV transmission line circuit breakers tripped due to transformer T1A-3 faulting on its primary side. This caused the other 161kV to 4160V transformer, T1A-4, to lose power. With both 161kV to 4160V transformers deenergized, the vital busses 1A3 and 1A4 lost power. This placed the station in a condition of having power to non-vital buses 1A1 and 1A2, but not to vital buses 1A3 or 1A4. Both emergency diesel generators started and loaded on their respective vital buses as designed. All systems responded as designed.

The cause of this event was the inappropriate actuation of the deluge system for transformer T1A-3 which caused the fault. The root cause for the deluge system failure was the failure of two valves in the system.

Completed corrective actions for this event include: checking transformer T1A-3 to ensure no damage to the transformer occurred, correcting problems noted in the inspection of the deluge system, and having an operator check the appropriate deluge systems twice daily to ensure a similar problem does not develop. In the long term the preventive maintenance actions for deluge systems will be evaluated and upgraded as required.

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| Fort Calhoun Station Unit No. 1 | 05000285 | 1998           | 005               | 00              | 2 OF 5   |

TEXT (if more space is required, use additional copies of NRC Form 366A) (17)

## BACKGROUND

The Fort Calhoun Station (FCS) has two sources of off-site power that can be made available to the major busses in the station. A 161kV source can supply either of two transformers which will provide 4160V power to the station busses. The 161kV to 4160V transformers are T1A-3 (EIIS: XFMR) and T1A-4 (EIIS: XFMR). The station's main transformer, T1 (EIIS: XFMR), is a 22kV to 345kV transformer. Transformer T1 is also capable of backfeeding the 22kV bus. The 22kV to 4160V transformers are T1A-1 (EIIS: XFMR) and T1A-2 (EIIS: XFMR). The station's two nonvital 4160V busses are 1A1 (EIIS: BU) and 1A2 (EIIS: BU). The station's vital 4160V busses are 1A3 (EIIS: BU) and 1A4 (EIIS: BU).

When the station's main generator is shutdown, the main transformer is normally used to supply power to the two nonvital busses. In addition, as required there are two emergency diesel generators (DGs) which can supply the vital busses.

The usual lineup for the system when the plant is shutdown is for T1 to be backfed from the 345kV system with T1A-1 supplying bus 1A1 and T1A-2 supplying 1A2. The vital busses are usually fed from the 161kV system with T1A-3 supplying 1A3 and T1A-4 supplying 1A4.

## EVENT DESCRIPTION

On May 20, 1998, the plant was in a refueling outage with the following conditions:

The plant was in mode 5 with a plant startup in progress.  
The electrical plant was lined up as indicated in the background information section of this LER.

At 1410 Central Daylight Time (CDT), on May 20, 1998, the 161kV transmission line circuit breakers tripped due to transformer T1A-3 faulting on its primary side. This caused transformer T1A-4 to lose power, as designed, since T1A-3 and T1A-4 are connected on the primary side. With both 161kV to 4160V transformers deenergized the vital busses, 1A3 and 1A4, lost power. This placed the station in a condition of having power to non-vital buses 1A1 and 1A2, but not to vital buses 1A3 or 1A4. Both DGs started and loaded on their respective vital busses as designed. The Shutdown Cooling pumps lost power for about 10 seconds until this load was automatically picked up by the diesel generators when the vital busses were reenergized by the DGs. The Spent Fuel Pool Cooling pump was manually restarted shortly after power was restored. All systems responded as designed.

At approximately the same time, a Control Room Operator noted that both the electric and diesel driven Fire Pumps were running. Abnormal Operating Procedure AOP-32, "Loss of 4160 Volt or 480 Volt Bus Power", was entered. At 1431 CDT the event classification Unusual Event was entered pursuant to 10CFR50.72(B)(1)(vi) (other-hampering operation).

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| Fort Calhoun Station Unit No. 1 | 05000285 | <table border="1"><tr><th data-bbox="1013 241 1117 277">YEAR</th><th data-bbox="1122 241 1252 277">SEQUENTIAL<br/>NUMBER</th><th data-bbox="1256 241 1360 277">REVISION<br/>NUMBER</th></tr></table> | YEAR                 | SEQUENTIAL<br>NUMBER | REVISION<br>NUMBER | 3 OF 5 |
|                                 |          | YEAR   | SEQUENTIAL<br>NUMBER | REVISION<br>NUMBER   |                    |        |
| 1998 - 005 - 00                 |          |  |                      |                      |                    |        |

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Station staff observed that transformer T1A-3 was engulfed in water spray from the transformer deluge system. This deluge condition lasted until 1453 when the deluge system was manually isolated by Operations.

At 1506 CDT the NRC Operations Center was notified of the event.

By 1559 CDT all station power was being supplied by the 22kV to 4160V transformers T1A-1 and T1A-2 and the DGs were shutdown. This event is being reported pursuant to 10CFR50.73(a)(2)(iv).

## SAFETY SIGNIFICANCE

The direct effect of this event was the loss of the 161kV power source resulting in the loss of off-site power to the engineered safeguards (vital) buses. USAR section 8.2 describes the ability of the electrical distribution system to sustain a loss of offsite power. The electrical distribution system (including the DGs) responded appropriately in accordance with design parameters.

The indirect effects of this event were the momentary interruption of power to the shutdown cooling pumps and the temporary loss of spent fuel pool cooling. Due to the short duration of the loss of power to these components and the large inventory of cooling media available, the effect of the loss of off-site power was negligible.

## CONCLUSION

There was no observed damage to the transformer from fire. Diagnostic checks and inspections of T1A-3 by Omaha Public Power District (OPPD) substation personnel were all satisfactory. Since there was no indication of a problem with the transformer, it was postulated that the deluge valve, FP-754, for T1A-3 had inadvertently opened causing a deluge of the transformer and subsequent tripping.

System Engineering, with the assistance of the Operations Department, conducted a test of the deluge system to determine the root cause of the inadvertent opening of FP-754 (EIIIS: XCV). This testing included of setting up the system in as near a configuration as could be duplicated from the original event. System Engineers were stationed at points of interest throughout the station, monitoring the Fire Protection system to determine various characteristics of the system such as pump start times, system pressures, and transformer deluge spray times after a valid deluge valve actuation signal.

This testing demonstrated conclusively that the deluge valve, FP-754 inadvertently opened, which caused the fire main pressure to rapidly decrease, which started both fire pumps. This, in turn, caused a full flow deluge of T1A-3 and subsequent trip of the transformer, the 161kV transmission line, and loss of the vital buses. The deluge valve sprayed the energized transformer with conductive water, causing phase "B" to ground and phase "B" to "C" faults on the primary side of the transformer. The "B" phase to ground fault current was approximately 7555 amps lasting 187.1 milliseconds, and the "B" to "C"



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phase fault current was approximately 9500 amps lasting 274.3 milliseconds. All fault current was delivered from the 161kV system, and not the transformers.

After performance of the testing, troubleshooting activities commenced with the deluge valve system to determine if faulty component(s) existed. This testing demonstrated that an alarm test valve and a check valve were leaking by, allowing the transformer sprinkler header to slowly fill with water. During the previous day, a system flush and alarm test of the T1A-3 deluge system had been conducted. During the procedure, the operator returned the isolation valve to what he thought was the closed position, and in doing so, moved the ball valve past the 90 degree position, allowing a slow leakage of water from the fire main and into the sprinkler header. It was later determined that the alarm test valve had a bent valve stop that allowed it to be positioned past the closed position.

This condition allowed water to fill the sprinkler header piping and reach a height of approximately 13 feet above a pressure operated relief valve (porv) (EIIS: V). This porv had a setpoint of about 6 pounds per square inch (psi). The pressure of the water simulated an actual deluge event which actuated the porv allowing the deluge valve to operate. The porv is designed to maintain a positive vent above the deluge valve on actuation.

The Fire Protection system, with the exception of the deluge system for T1A-3, worked as designed. However, the failure of check valve FP-342 (EIIS: CKV) and ball valve FP-230 (EIIS: ISV), together, caused the event. The failure of this equipment is considered unacceptable due to the impact on other station equipment (T1A-3, T1A-4 and associated buses). In addition, a lack of appropriate preventive maintenance on this type of equipment could lead to inadvertent actuation of other deluge systems.

## CORRECTIVE ACTIONS

During the evening hours on May 20, 1998, OPPD Substation personnel began examining the transformer for damage. The following checks were made to T1A-3:

- Oil analysis for dielectric
- Oil level
- Power factor - windings and bushings
- Compared excitation current with earlier outage test
- Transformer turns ratio test
- Lightning arrestor examination

All of the above test results were satisfactory. The only repairs made to T1A-3 were to file rough surfaces on the bushings to reduce corona potential, and cleaning glazing damage on bushings and sealing them with Glyptol.

The deluge system for T1A-3 was inspected and repaired, including replacing check valve FP-342 and ball valve FP-230. As a precaution, all similar deluge valves have been inspected for similar failure modes.

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As an additional short term corrective action a memorandum was issued directing the turbine building operator to check and drain as necessary the appropriate portion of the deluge piping for the station transformers as part of their regular rounds. This action will continue until further evaluation indicates it is no longer necessary.

In the long term the preventive maintenance actions for the deluge systems will be evaluated and upgraded as required. Additionally, OPPD will complete a review of the preventive maintenance activities for the Fire Protection system to assure that it will operate satisfactorily without inadvertent actuations. This review will be completed by November 20, 1998.

## PREVIOUS SIMILAR EVENTS

In June of 1979 FCS experienced a plant trip due to inadvertent actuation of a deluge valve over the main turbine lube oil reservoir.

# CATEGORY 1

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9806220368 DOC.DATE: 98/06/19 NOTARIZED: NO DOCKET #  
FACIL:50-285 Fort Calhoun Station, Unit 1, Omaha Public Power Dist 05000285  
AUTH.NAME AUTHOR AFFILIATION  
MATZKE,E. Omaha Public Power District  
GAMBHIR,S.K. Omaha Public Power District  
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 98-005-00:on 980520,161 kV transmission line circuit  
breakers tripped.Caused by inappropriate actuation of deluge  
sys for transformer T1A-3.Transformer T1A-3 was checked to  
ensure no damage to transformer occurred.W/980619 ltr.

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### NOTES:

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|           | NOAC POORE,W.             | 1 1                 | NOAC QUEENER,DS           | 1 1                 |
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June 19, 1998  
LIC-98-0079

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Mail Station P1-137  
Washington, DC 20555

Reference: Docket No. 50-285

Subject: Licensee Event Report 1998-005 Revision 0 for the Fort  
Calhoun Station

Please find attached Licensee Event Report 1998-005 Revision 0 dated  
June 19, 1998. This report is being submitted pursuant to  
10CFR50.73(a)(2)(iv). If you should have any questions, please contact  
me.

Sincerely,

S. R. Gambhir  
Division Manager  
Engineering & Operations Support

EPM/epm

Attachment

c: E. W. Merschhoff, NRC Regional Administrator, Region IV  
L. R. Wharton, NRC Project Manager  
W. C. Walker, NRC Senior Resident Inspector  
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